PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:
B26F 1/12, B26D 7/01	A1	WO 93/08963
		(43) International Publication Date: 13 May 1993 (13.05.93)

(21) International Application Number: PCT/EP92/02429

(22) International Filing Date: 22 October 1992 (22.10.92)

(30) Priority data:
9113547 28 October 1991 (28.10.91) FR

(71) Applicant *(for FR only)*: KODAK-PATHE [FR/FR]; 26, rue Villiot, F-75594 Paris Cédex 12 (FR).

(71) Applicant *(for all designated States except FR US)*: EASTMAN KODAK COMPANY [US/US]; Patent Legal Staff, 343 State Street, Rochester, NY 14650 - 2201 (US).

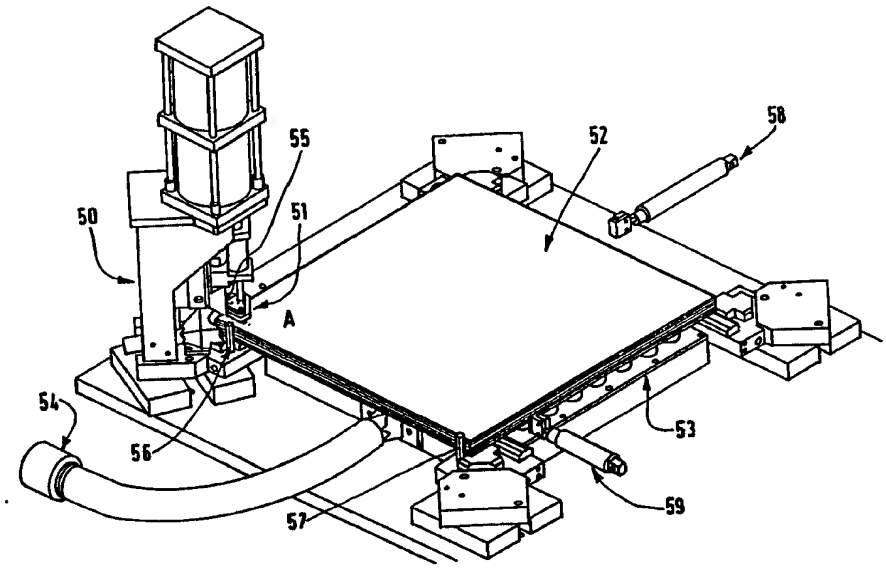
(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : LONG, Michael [US/US]; 306 Applewood Drive, Rochester, NY 14612 (US).

(74) Agent: BUFF, Michel; Kodak-Pathé, Département Brevets, CRT - Zone Industrielle, F-71102 Chalon-sur-Saône Cédex (FR).

(81) Designated States: JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE).

Published
With international search report.

(54) Title: METHOD AND APPARATUS FOR PRODUCING A ROUNDED CORNER AT EACH CORNER OF A PILE OF SHEETS



(57) Abstract

The invention relates to a method and apparatus used for rounding the corners of a pile of sheets (52). According to one of the embodiments of the method according to the present invention, air is injected between the sheets in the pile (52) so as to create a lubricating fluid film between the said sheets; at least one of the corners of the pile (52) is placed in abutment against two reference surfaces (55, 56, 57) formed facing at least one corner of the pile, and the four cutting devices (50) corresponding to each corner are actuated. Application to the manufacture of X-ray films.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	MR	Mauritania
AU	Australia	GA	Gabon	MW	Malawi
BB	Barbados	GB	United Kingdom	NL	Netherlands
BE	Belgium	GN	Guinea	NO	Norway
BF	Burkina Faso	GR	Greece	NZ	New Zealand
BG	Bulgaria	HU	Hungary	PL	Poland
BJ	Benin	IE	Ireland	PT	Portugal
BR	Brazil	IT	Italy	RO	Romania
CA	Canada	JP	Japan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SK	Slovak Republic
CI	Côte d'Ivoire	LI	Liechtenstein	SN	Senegal
CM	Cameroon	LK	Sri Lanka	SU	Soviet Union
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	MC	Monaco	TG	Togo
DE	Germany	MG	Madagascar	UA	Ukraine
DK	Denmark	ML	Mali	US	United States of America
ES	Spain	MN	Mongolia	VN	Viet Nam
FI	Finland				

METHOD AND APPARATUS FOR PRODUCING A ROUNDED CORNER AT EACH CORNER OF A PILE OF SHEETS

The invention relates to a method for producing a rounded corner at each corner of a pile of sheets, and is particularly suited to products such as X-ray films. The present invention relates also to apparatus enabling the method according to the invention to be implemented.

It is known that materials in sheets such as X-ray films or cards such as bank cards must have rounded corners.

According to a first known technique, such rounded corners are produced by making notches initially, having the shape of the rounded corner common to two adjacent sheets, on the edges of a moving strip and then cutting the strip in the middle of the said notch. The problem with such a technique lies in the difficulty in positioning the cutting device correctly with respect to the centre of the notch. In fact, the slightest error in the positioning of the cutting device will result in an incomplete rounded corner on one of the sheets and an unwanted strip at the end of the other sheet.

Another known technique involves stopping the process whilst positioning and producing the rounded corners on the sheet which has just been cut. This technique is of course detrimental from the point of view of productivity.

There are also other systems, such as line rotating systems, but which have great problems related to the complexity of the operations required for passing from one format to another.

Fig 1, to which reference is now made, illustrates another known type of device enabling the corners of a pile of sheets to be rounded.

The device shown comprises principally an inclined plane 1 on which the sheets 2 are positioned, two reference surfaces 3, 4 at right angles to each other being provided on the said inclined plane 1 and against which the sheets

are positioned under the effect of gravity. Advantageously vibration is applied to the reference surfaces so as to permit a better positioning of the sheets against the two reference surfaces 3, 4. The reference surfaces are separated from the bottom corner of the inclined plane 1 so as to be able to dispose a cutting tool between the said two reference surface 3, 4, the said cutting tool being designed so as to produce the desired shape of the rounded corner. In the example shown, the cutting device 5 comprises a curved blade movable in a reciprocating motion in the direction shown diagrammatically by the two directional arrows 6. The rounded corners in each corner of the pile are produced successively by moving the said pile manually.

The main problem with such a device lies in the positioning of the sheets against the reference surfaces. The device shown in Fig 1 functions satisfactorily when the sheets in the pile are, initially, relatively well aligned so that the length of each sheet protruding beyond the edge of the normal alignment of the pile is sufficiently small to withstand a force applied axially without causing any deformation of the sheets with respect to the surface of the inclined plane 1.

It is obvious that such a method is limited to applications in which the sheets are relatively rigid and relatively well aligned initially and in which the friction between the sheets is sufficiently small. In the context of the manufacture of photographic films, such as X-Ray products, in addition to these limitation there is a fact that the photosensitive layers on the photographic products can be damaged by the abrasion between the sheets and, particularly at the edges in contact with the reference surfaces 3, 4, because of the forces resulting from this contact. Thus one of the objects of the present invention is to provide a method making it possible to produce a rounded corner at each of the corners of a pile of sheets,

without damaging the said sheets when the pile is positioned with respect to the cutting tools.

Another object of the present invention is to provide a device enabling the method according to the present invention to be implemented.

Yet another object of the present invention is to provide a method and an apparatus making it possible to produce rounded corners at the four corners of a pile of sheets, at least one of the dimensions of which (length and/or width) may be variable from one sheet to another in the pile.

These objects are achieved by means of a method for producing rounded corners at the four corners of a pile of sheets of substantially equal dimensions by means of an apparatus comprising four cutting devices disposed at the four corners of a substantially rectangular surface and means suitable for positioning the said sheets correctly with respect to the cutting devices against components defining two reference surfaces at right angles to each other at at least one corner of the said substantially rectangular surface, the said method comprising the following steps:

a) injecting air between the sheets in the said pile so as to create a lubricating fluid film between the said sheets in the pile;

b) placing at least one of the corners of the pile in abutment against the two reference surfaces of at least one of the corners of the said substantially rectangular surface comprising such reference surfaces;

c) actuating the four cutting devices so as to produce the desired rounded corner at each of the four corners.

According to another embodiment of the present invention, a method is provided for producing, in pairs, rounded corners at the four corners of a pile of sheets having one of their dimensions (length or width) variable from one sheet to another in the pile, the other dimension

being substantially constant for all the sheets in the said pile, by means of an apparatus comprising four cutting devices disposed at the four corners of a substantially rectangular surface and means suitable for accurately positioning the said sheets with respect to the cutting devices against two reference surfaces at right angles to each other formed at one corner of each of the ends of the said substantially rectangular surface along the axis of the variable dimension of the said sheets, the said method comprising the following steps:

a) injecting air between the sheets in the said pile so as to create a lubricating fluid film between the said sheets;

b) placing a first corner of the pile in abutment against the two reference surfaces of the first end of the substantially rectangular surface;

c) actuating the cutting device simultaneously at each corner of the first end of the substantially rectangular surface;

d) placing a second corner of the pile in abutment against the two reference surfaces of the second end of the said substantially rectangular surface;

e) actuating the cutting device simultaneously at each corner of the second end of the substantially rectangular surface.

According to yet another embodiment of the method according to the present invention, rounded corners are produced successively at the four corners of a pile of sheets by means of an apparatus comprising four cutting devices disposed at the four corners of a substantially rectangular surface and means suitable for successively positioning the said sheets with respect to each of the cutting devices against two reference surfaces at right angles to each other provided at each corner of the said substantially rectangular surface, the said method comprising the following steps:

a) injecting air between the sheets in the said pile so as to create a lubricating fluid film between the said sheets in the pile;

b) moving the said pile of sheets, in two directions at right angles to each other, so as to press a first corner of the said pile against the two corresponding reference surfaces;

c) actuating the cutting device corresponding to the said corner so as to produce the desired rounded corner;

d) repeating steps b) and c) for the other three corners.

The method according to the present invention is implemented by means of a device making it possible to produce rounded corners at the four corners of a pile of sheets comprising four cutting devices making it possible to produce the desired shape of the rounded corner and disposed at the four corners of a substantially rectangular surface, and means suitable for correctly positioning the said sheets with respect to the said cutting devices, the said apparatus being characterised in that the said positioning means comprise:

a) means intended to direct air over substantially the entire height of at least one of the edges of the pile in order to inject air between the sheets in the said pile;

b) components forming a stop disposed so as to define, at at least one corner of the said substantially rectangular surface, two reference surfaces at right angles to each other;

c) components which are movable in translation, disposed facing and substantially perpendicular to at least two sides of the pile and acting so as to position at least one corner of the pile against the two reference surfaces of at least one corner of the said substantially rectangular surface.

According to another embodiment of the apparatus, the sheets in the pile have one of their dimensions (length or

width) variable from one sheet to another in the pile, the other dimension being substantially identical for all the sheets in the pile, the said stop means being disposed so as to form two reference surfaces at one corner of each end of the pile along the axis of the variable dimension of the said sheets, movable components being disposed facing and substantially perpendicular to at least three sides of the pile and acting so as to successively push two corners of the pile in two directions at right angles to each other against the two reference surfaces corresponding to the corners of the substantially rectangular surface comprising such reference surfaces.

According to yet another embodiment, the said stop means are disposed so as to form two reference surfaces at each corner of the said substantially rectangular surface, the movable components being disposed facing and substantially perpendicular to the four sides of the pile and acting so as to push each corner of the pile successively in two directions at right angles to each other against the two reference surfaces of the corresponding corner of the said substantially rectangular surface.

In the detailed description which follows, reference will be made to the drawing in which:

- Fig 1 shows a conventional device for producing rounded corners at the four corners of a pile of sheets;
- Fig 2 shows a first embodiment of the device according to the present invention;
- Fig 3 is a diagrammatic representation of one of the devices intended to blow air between the sheets in the pile;
- Fig 4 shows a second embodiment of the device according to the present invention;
- Fig 5 shows yet another embodiment of the device according to the present invention;
- Fig 6 shows a variant of the embodiment of Fig 5; and

- Fig 7 illustrates diagrammatically the steps of the method implemented by the device of Fig 6.

Fig 2, to which reference is now made, shows a first embodiment of the device according to the present invention. This embodiment is particularly suited to piles of sheets having dimensions (width and length) which are substantially identical and makes it possible to produce the four rounded corners simultaneously after a single positioning operation.

The device comprises four cutting devices 50 (for reasons of clarity, only one of these devices is shown). These cutting devices are disposed at the four corners of a substantially rectangular surface, the dimensions of which (length and width) are at least equal to the respective maximum dimensions of the sheets. The cutting devices are, by way of example, of the punch/blanking die type, the said punches being controlled by a pneumatic jack. According to the embodiment shown, pressing means 51 are provided so as to press on the corresponding corner of the said pile 52 so as to keep the sheets in the pile positioned before carrying out the cutting of the said corresponding rounded corner. Such cutting devices are well known in the art and consequently require no further description.

The device according to the present invention also comprises a support 53 intended to receive the said pile of sheets. In a preferred embodiment this support defines a plane surface produced by the top part of at least one tubular chamber connected by suitable means 54 to a source of compressed air. Each chamber has on its top face a plurality of holes disposed so as to be distributed over substantially the entire surface of the pile. Such an arrangement makes it possible, when air is injected through the said holes, to create a fluid film between the pile 52 and the support 53, thus facilitating the sliding and consequently the positioning of the pile against the reference surfaces, which will be discussed in more detail

below. The device shown in Fig 2 also comprises components forming a stop 55, 56, 57 disposed so as to define at at least one corner of the said substantially rectangular surface two reference surfaces at right angles to each other. According to the embodiment shown, these two reference surfaces are defined by three studs. Two of these studs 55, 56 are disposed at one corner of the said substantially rectangular surface (one of them 55 being partially concealed behind the pressing device 51), one stud being disposed facing each of the faces of the pile defining the corresponding corner. The third stud 57 is also disposed facing one of the faces of the pile defining the said corner so as to define, in interaction with the other two studs, two bearing surfaces at right angles to each other. It is obvious that the greater the distance between the third stud and the first two studs, the greater will be the accuracy of positioning of the sheets against the studs. The third stud 57 is, in the embodiment shown in Fig 2, disposed approximately at a corner adjacent to the corner which has the first two studs. It is obvious that all these studs and all the devices described below which make up the positioning means must be at a distance from each of the corners which at least equal to the radius of the rounded corners to be produced so as to allow the passage of the cutting tool. The device also comprises means intended to direct compressed air 55, 56, 57 over substantially the entire height of at least one of the edges of the pile of sheets. The possible arrangements of such means are manifold. By way of example, such a means is disposed facing one of the faces of the pile, substantially at the middle of the said face. According to another example, such means are disposed facing two faces of the pile, each one being disposed substantially at the middle of the corresponding face of the pile. In the embodiment shown in Fig 2, these means intended to inject air also fulfil the stop function described above and, as

shown in more detail in Fig 3, are in the form of a nozzle 60 consisting of a cylinder closed at both ends and connected to a source of air (not shown). The said cylinder has over substantially its entire length a narrow slot 61 enabling the jet of air to be distributed over the entire height of the said pile. Preferentially, the said narrow slot 61 is wider in the portion arranged facing the bottom part of the pile than in the portion facing the top part of the pile so as, because of the differences in forces exerted on the sheets at the top compared with the sheets at the bottom, to make the thickness of the lubricating fluid film created between each of the sheets in the pile uniform over the entire height of the pile. It is of course obvious that the number of nozzles to be used depends on their positioning, on the size of the sheets and on the height of the pile. In the embodiment shown in Fig 2, three nozzles 55, 56, 57 are used, connected to a source of compressed air, the air preferably first being dried and filtered. As already mentioned, the three nozzles are disposed so as to define also the two reference surfaces described above.

The device according to the present invention also has components which are movable in translation 58, 59 disposed facing and substantially perpendicular to at least two sides of the pile 52 and acting so as to position at least one corner A of the pile against the two reference surfaces as defined above. In Fig 2, a pneumatic jack is disposed facing each of the faces of the pile, opposite those facing the two reference surfaces described above. The arrangement and number of such movable devices also depends on the size of the sheets. By way of example, two jacks are provided facing each of the said surfaces. During operation, the chambers forming the pile support and the lateral nozzles 55, 56, 57 are supplied with compressed air so as to separate each sheet in the pile by means of a lubricating fluid film; the two pneumatic jacks 58, 59 are

actuated so as to position one of the corners A of the pile of sheets against two perpendicular reference surfaces; finally the cutting devices are actuated at each of the four corners. Preferably, the four cutting devices are actuated simultaneously. Such an arrangement is particularly suited where the sheets forming the pile are substantially of equal width and equal length, the four corners being perfectly positioned when any one of them is in abutment against two reference surfaces, substantially of equal width and equal length, resulting in differences between the sheets in any one pile not exceeding the tolerances allowed in the position and size of the rounded corner.

Fig 4, to which reference is now made, illustrates another embodiment of the present invention, particularly suited to piles of sheets, one of the dimensions of which (length or width, represented by the axis X) is variable from one sheet to another in the pile, the other dimension being substantially identical for all the sheets in the pile. According to this embodiment the stop means 12, 13, 14, 15 are arranged in pairs so as to form two reference surfaces at a corner A, D of each end of the pile along the axis X of the variable dimension of the said sheets. In the same way as for the previous embodiment, the means forming a stop 12, 13, 14, 15 preferably consist of nozzles connected to a source of compressed air making it possible, at least for some of them, in addition to the stop function, to inject air between the sheets in the said pile. In the embodiment shown in Fig 4, the two pairs of reference surfaces are formed at two adjacent corners A, D of the said substantially rectangular surface. According to another embodiment the two pairs of reference surfaces are formed at two opposite corners A, C of the pile, each of the pairs of reference surfaces being, as explained above, formed by at least three bearing points.

The device also comprises movable components 16, 17, 18

disposed facing and substantially perpendicular to at least three sides of the pile acting in pairs so as to push two corners of the pile successively, in two directions at right angles to each other, against each of the pairs of corresponding reference surfaces.

Where the pairs of reference surfaces are disposed at two opposite corners of the substantially rectangular surface, it is obvious that components movable in translation must be provided facing each of the faces of the packet of sheets. In the same way as in the previous embodiment, the movable components 16, 17, 18, consist of pneumatic jacks, and the end of the jacks in contact with the sheets can be provided with a pad 19 formed from a suitable flexible material, such as, for example, silicone, so as not to damage the edges of the sheets when the said jacks press on the said sheets. The embodiment shown provides for a single pneumatic jack disposed substantially at the middle of three of the faces of the packets of sheets. It is obvious that a greater number of them could be provided on each of the faces, depending in particular on the size of the sheets.

The steps of the method implemented by means of the device shown in Fig 4 will be described starting from the case in which the variable dimension is the one along the axis shown diagrammatically by the double arrow X. In operation, the nozzles forming a stop 12, 13, 14, 15, and, if applicable, the chambers forming the pile support are fed so as to create a lubricating film between each of the sheets; the corner A of the pile is placed in abutment against the stops 12, 14, 15, by moving the pneumatic jacks 17, 18 against the corresponding surfaces of the pile; the cutting devices at the corners A and B are actuated simultaneously; the corner D is placed in abutment against the stops 12, 13, 14 by moving the pneumatic jacks 16, 17 against the corresponding surfaces of the pile; finally, the cutting devices at the corners C and D are actuated

simultaneously.

Fig 5, to which reference is now made, shows another embodiment of the present invention, particularly suited to a pile of sheets in which both dimensions (length and width) are variable from one sheet to another in the pile. According to this embodiment, the stop means 46, 47, 48, 49, 70, 71, 72, 73, are arranged in pairs at each of the four corners of the substantially rectangular surface defined by the four cutting devices. Once again, at least some of the means forming a stop preferably consist of nozzles connected to a source of compressed air thus making it possible, in addition to the stop function, to inject air between the sheets in the said pile. According to another embodiment, the means forming a stop are separate from the means enabling air to be blown between the sheets. Components which are movable in translation 40, 41, 42, 43, 44, 45, are disposed facing each face of the pile so as to place each corner of the pile successively in abutment against the two corresponding reference surfaces. According to the embodiment shown in Fig 5, two of the faces of the pile are facing two movable components (one of them 45 being hidden by the cutting device shown), the two other faces of the pile being facing a single movable component disposed substantially at the middle of the corresponding face of the packet of sheets.

In Fig 6, which shows a variant of the embodiment of Fig 5, the components movable in translation 21-28 are disposed in pairs at each of the four corners of the device, close to the components forming a stop. Advantageously, at least some of the components forming a stop can, in addition to blowing air between the sheets, be movable in translation so that it is no longer necessary to provide auxiliary movable means.

During the operation of such an embodiment, after supplying with compressed air the eight components intended for this purpose, as well as, if applicable, the chambers

forming the support of the device, the movable components 22, 23 and 25 are actuated so as to place the pile in abutment against the components forming a stop X, Y and Z defining two reference surfaces at right angles to each other at a first corner. The cutting device corresponding to the said first corner is actuated. The same operations are repeated successively for the other three corners of the pile. These different steps are illustrated more plainly in Fig 7, the sign X representing, for each step of the method, the cutting device to be actuated.

In all the above description, certain components such as, for example, the pile support and the cutting devices, are common to all the embodiments and in consequence have not been described systematically for each of the embodiments mentioned.

In all the embodiments described in which the sheets have at least one of their dimensions variable from one sheet to another in the pile, the ends of the movable components in contact with the sheets are provided with suitable means enabling the variations in dimension to be absorbed. By way of example, for relatively small variations (of the order of 2 mm) a polyurethane foam, whose thickness is in accordance with the said variations in dimension, is disposed at the ends of the said movable components. For greater differences between the sheets, a nylon brush, whose density and length of bristle depends on the thickness of the sheets and the dimensional differences, can be disposed at the ends of the said movable components. The action of such means, combined with the lubricating fluid film between each of the sheets, makes it possible to compensate for variations in dimension which may be as much as 2 cm or more.

CLAIMS

1. Apparatus for producing rounded corners at the four corners of a pile of sheets (52) comprising four cutting devices (50) making it possible to produce the desired shape of the rounded corner and disposed at the four corners of a substantially rectangular surface, and means suitable for correctly positioning the said sheets with respect to the said cutting devices, the said apparatus being characterised in that the said positioning means comprise:

a) means intended to direct air (55, 56, 57) over substantially the entire height of at least one of the edges of the pile in order to inject air between the sheets in the said pile;

b) components forming a stop (55, 56, 57) disposed so as to define, at at least one corner of the said substantially rectangular surface, two reference surfaces at right angles to each other;

c) components which are movable in translation (58, 59), disposed facing and substantially perpendicular to at least two sides of the pile and acting so as to position at least one corner of the pile against the two reference surfaces of at least one corner of the said substantially rectangular surface.

2. Apparatus according to claim 1, characterised in that the said sheets have one of their dimensions (length or width) variable from one sheet to another in the pile, the other dimension being substantially identical for all the sheets in the pile, the said stop means (12, 13, 14, 15) being disposed so as to form two reference surfaces at one corner of each end of the pile along the axis (X) of the variable dimension of the said sheets, movable components (16, 17, 18) being disposed facing and substantially perpendicular to at least three sides of the pile and acting so as to successively push two corners of the pile (A, D) in two directions at right angles to each other

against the two reference surfaces corresponding to the corners of the substantially rectangular surface comprising such reference surfaces.

3. Apparatus according to claim 1, characterised in that the said stop means (46, 47, 48, 49, 70, 71, 72, 73) are disposed so as to form two reference surfaces at each corner of the said substantially rectangular surface, the movable components (40-45) being disposed facing and substantially perpendicular to the four sides of the pile and acting so as to push each corner of the pile successively in two directions at right angles to each other against the two reference surfaces of the corresponding corner of the said substantially rectangular surface.

4. Apparatus according to claim 3, characterised in that the dimension of the sheets varies from one sheet to another both in length and in width.

5. Apparatus according to claim 3 or 4, characterised in that the said components forming a stop comprise eight pins (46, 49; 70, 73) disposed in pairs at each of the four corners of the said substantially rectangular surface and in that it comprises at least six components (40-45), movable in translation, disposed and acting so as to push the four corners of the pile successively, in two directions at right angles to each other, against the two reference surfaces corresponding to each of the four corners, each of the four edges of the pile being facing at least one component movable in translation.

6. Apparatus according to claim 5, characterised in that the said positioning means comprise eight components (21-28) movable in translation and disposed in pairs facing each of the four edges of the pile.

7. Apparatus according to claim 6, characterised in that the said components movable in translation are disposed in pairs at each corner of the said substantially rectangular surface, each of the said movable components being disposed

close to a positioning pin.

8. Apparatus according to any one of claims 1 to 7, characterised in that the said means intended to inject air between the sheets in the pile consist of at least one nozzle (60) connected to a source of air, the said nozzle being in the form of a cylinder closed at both ends and having a narrow slot (61) over substantially its entire length.

9. Apparatus according to claim 8, characterised in that the said narrow slot (61) is wider in the portion disposed facing the bottom part of the pile than in the portion disposed facing the top part of the pile.

10. Apparatus according to claim 8 or 9, characterised in that the means intended to inject air between the sheets in the pile comprise a nozzle disposed substantially at the centre of one of the edges of the pile.

11. Apparatus according to claim 8 or 9, characterised in that the means intended to inject air between the sheets in the pile comprise two nozzles disposed singly opposite two edges of the said pile at right angles to each other, substantially in the middle of the two said edges.

12. Apparatus according to any one of claims 1 to 11, characterised in that it comprises a plane surface (53) supporting the pile of sheets on the inside of the substantially rectangular surface, the said surface (53) being defined by the top part of at least one tubular chamber connected to a source of air, the said plane surface being provided with holes distributed over substantially the entire surface of the pile.

13. Apparatus according to any one of claims 3 to 12, characterised in that the means intended to inject air between the sheets in the pile comprise eight nozzles disposed in pairs at each corner of the pile, the first nozzle of each pair being facing a first edge of the pile, the second being facing the second edge forming the corresponding corner.

14. Apparatus according to any one of claims 1 to 13, characterised in that the components movable in translation consist of pneumatic jacks.

15. Apparatus according to any one of claims 1 to 14, characterised in that the means intended to inject air between the sheets in the pile also fulfil the function of a stop so as to replace at least partially the components forming a stop.

16. Apparatus according to any one of claims 1 to 15, characterised in that the means intended to inject air between the sheets in the pile can be moved selectively in translation so as to replace the pusher devices at least partially.

17. Method for producing rounded corners at the four corners of a pile of sheets of substantially equal dimensions by means of an apparatus comprising four cutting devices disposed at the four corners of a substantially rectangular surface and means suitable for positioning the said sheets correctly with respect to the cutting devices against components defining two reference surfaces at right angles to each other at least one corner of the said substantially rectangular surface, the said method comprising the following steps:

a) injecting air between the sheets in the said pile so as to create a lubricating fluid film between the said sheets in the pile;

b) placing at least one of the corners of the pile in abutment against the two reference surfaces of at least one of the corners of the said substantially rectangular surface comprising such reference surfaces;

c) actuating the four cutting devices so as to produce the desired rounded corner at each of the four corners.

18. Method for producing, in pairs, rounded corners at the four corners of a pile of sheets having one of their dimensions (length or width) variable from one sheet to another in the pile, the other dimension being

substantially constant for all the sheets in the said pile, by means of an apparatus comprising four cutting devices disposed at the four corners of a substantially rectangular surface and means suitable for accurately positioning the said sheets with respect to the cutting devices against two reference surfaces at right angles to each other formed at one corner of each of the ends of the said substantially rectangular surface along the axis of the variable dimension of the said sheets, the said method comprising the following steps:

a) injecting air between the sheets in the said pile so as to create a lubricating fluid film between the said sheets;

b) placing a first corner of the pile in abutment against the two reference surfaces of the first end of the substantially rectangular surface;

c) actuating the cutting device simultaneously at each corner of the first end of the substantially rectangular surface;

d) placing a second corner of the pile in abutment against the two reference surfaces of the second end of the said substantially rectangular surface;

e) actuating the cutting device simultaneously at each corner of the second end of the substantially rectangular surface.

19. Method for producing rounded corners successively at the four corners of a pile of sheets by means of an apparatus comprising four cutting devices disposed at the four corners of a substantially rectangular surface and means suitable for successively positioning the said sheets with respect to each of the cutting devices against two reference surfaces at right angles to each other provided at each corner of the said substantially rectangular surface, the said method comprising the following steps:

a) injecting air between the sheets in the said pile so as to create a lubricating fluid film between the said sheets in the pile;

b) moving the said pile of sheets, in two directions at right angles to each other, so as to press a first corner of the said pile against the two corresponding reference surfaces;

c) actuating the cutting device corresponding to the said corner so as to produce the desired rounded corner;

d) repeating steps b) and c) for the other three corners.

20. Method according to claim 19, characterised in that the dimension of the sheets varies from one sheet to another in the pile, both in length and in width.

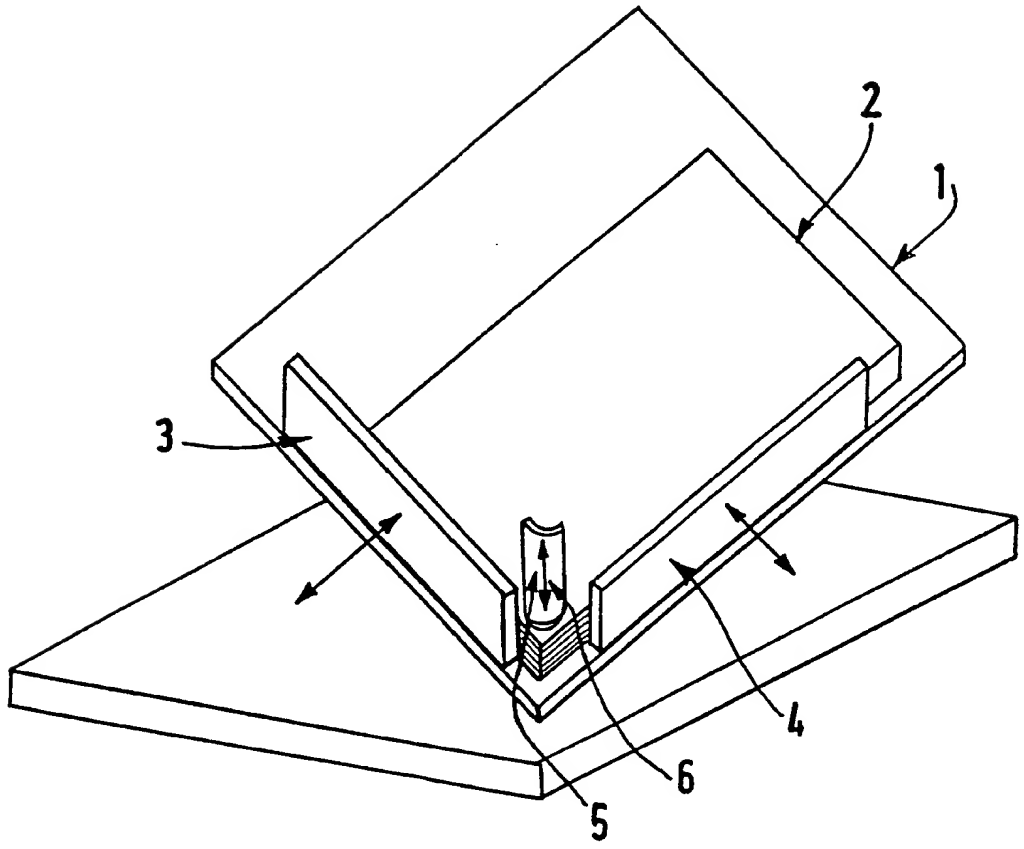


FIG.1

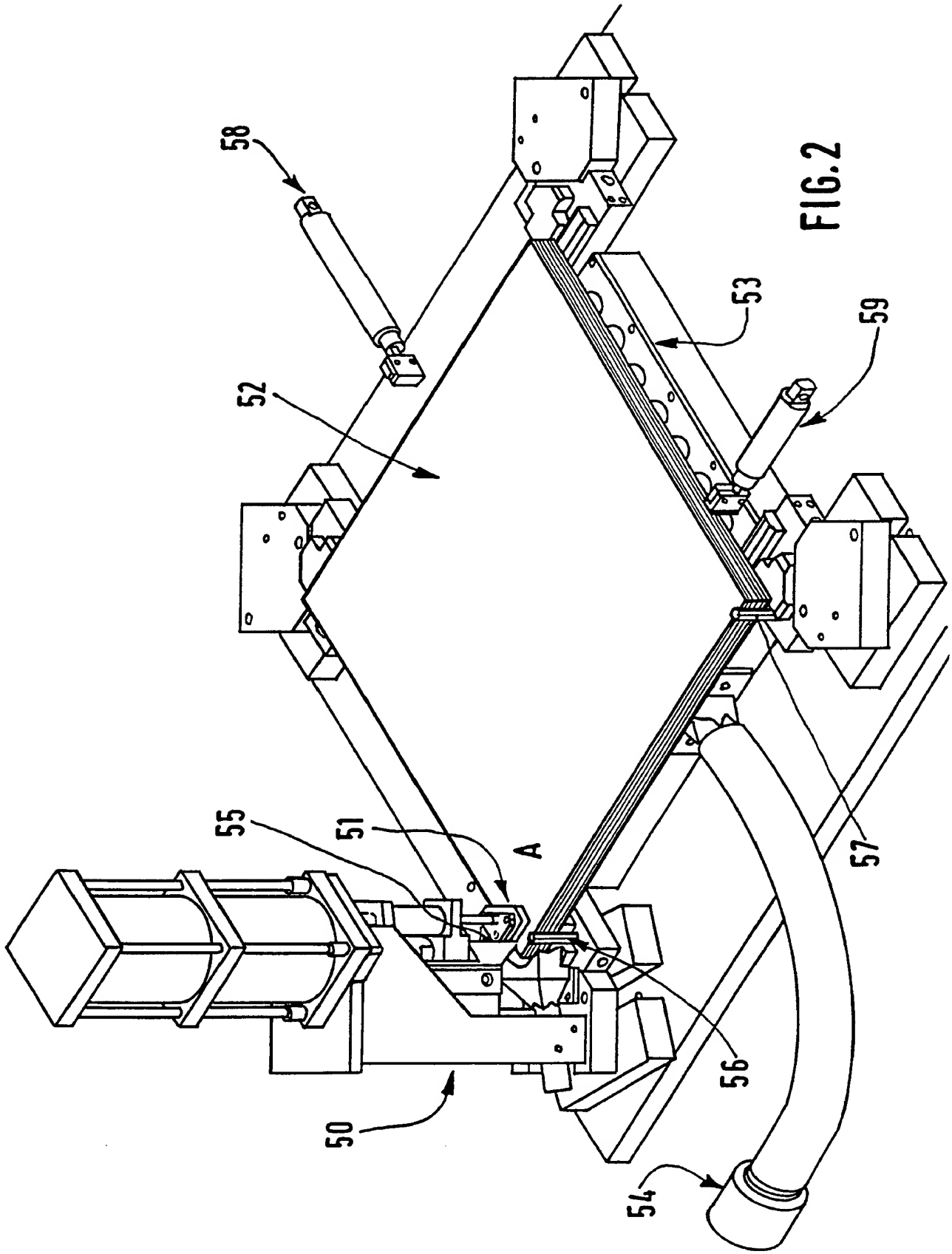


FIG.2

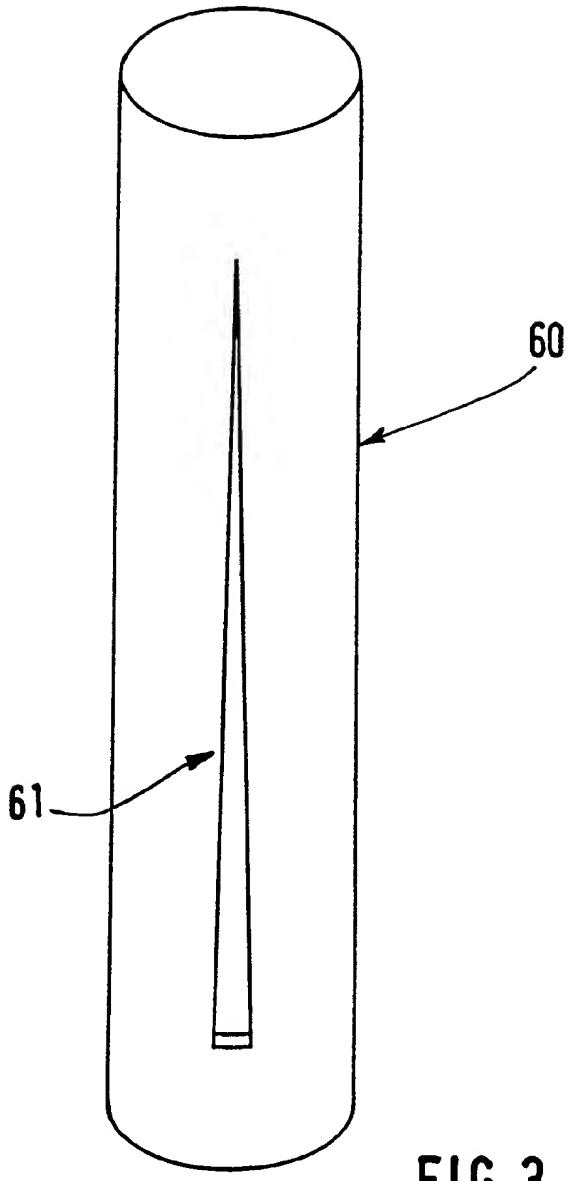


FIG. 3

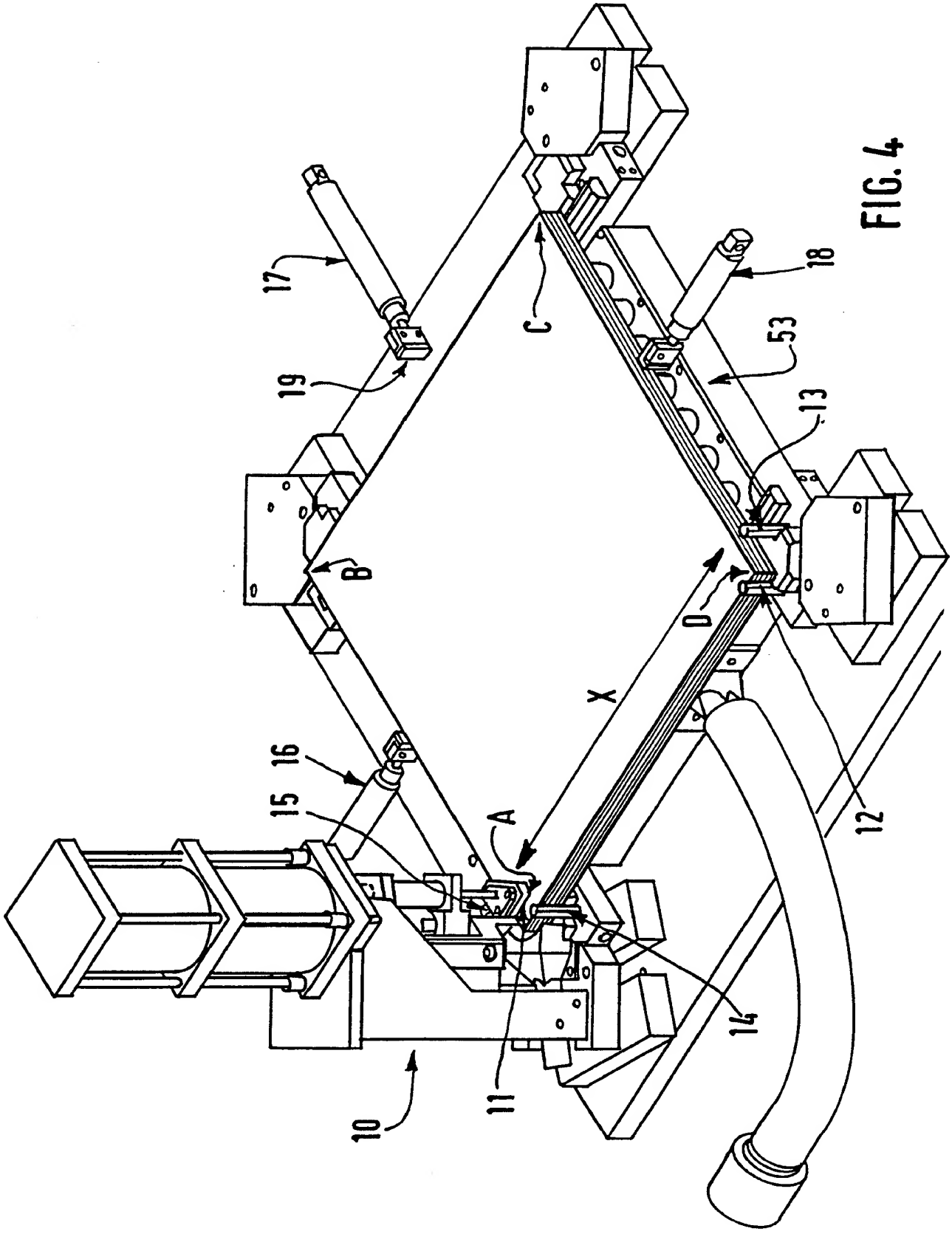


FIG. 4

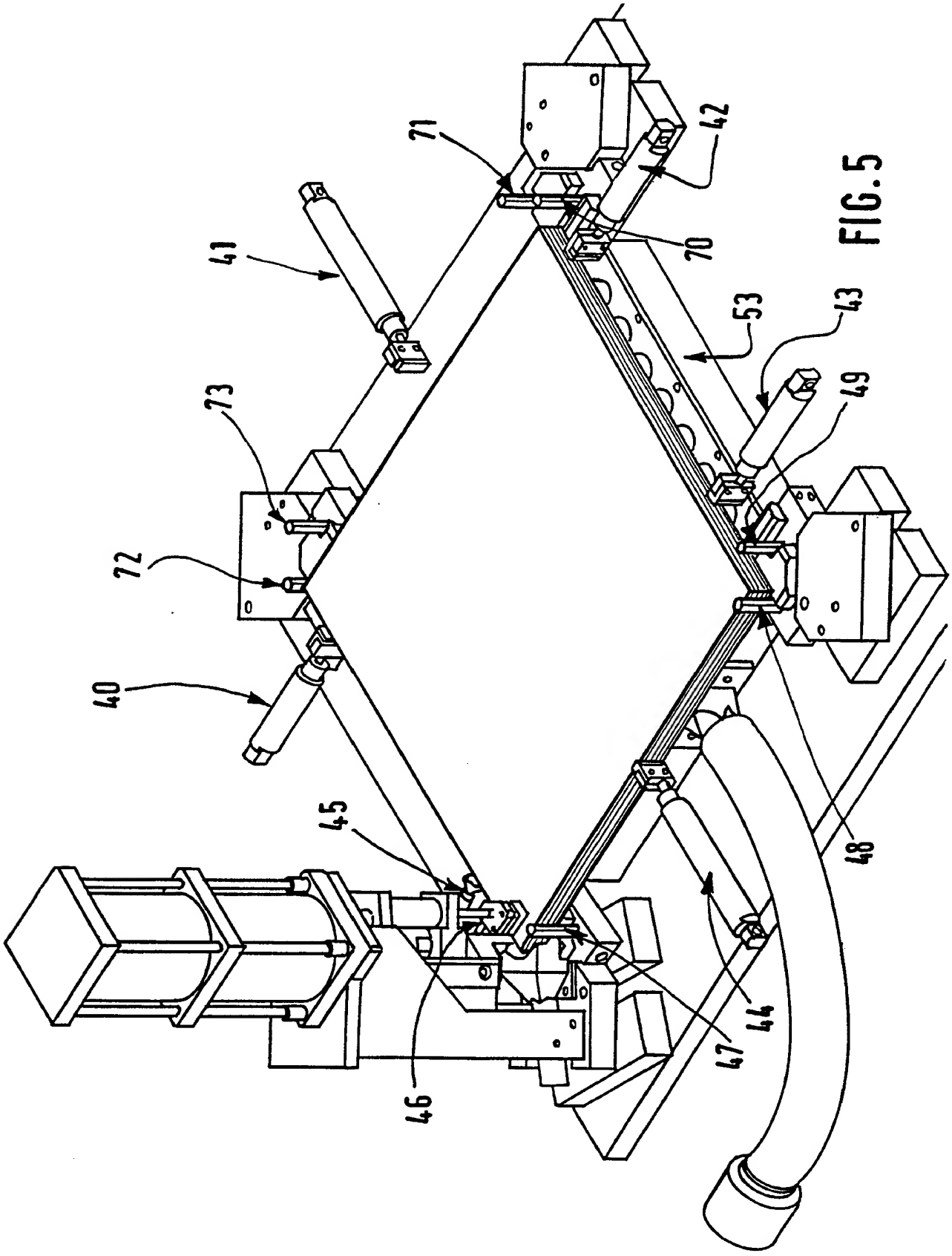


FIG.5

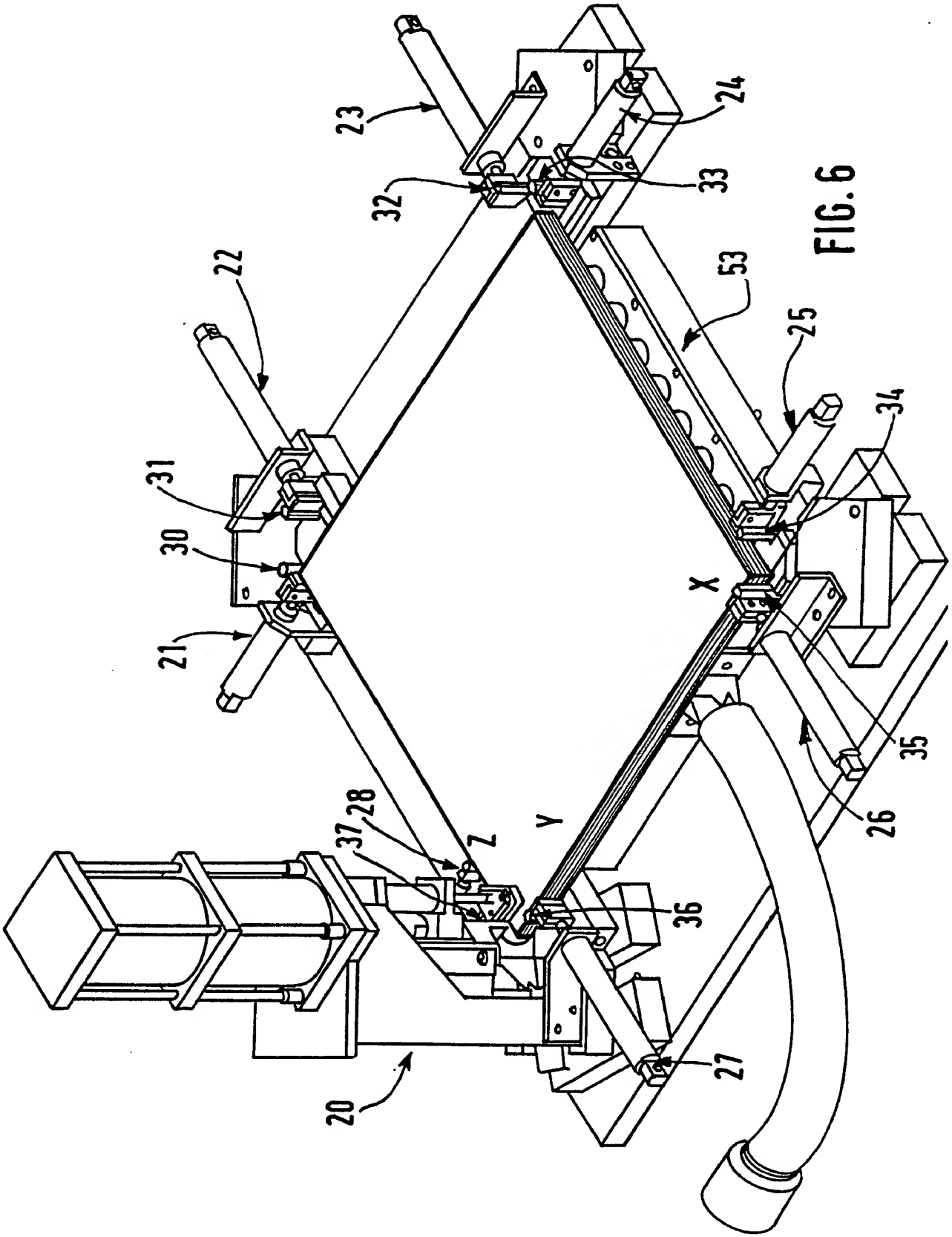


FIG. 6

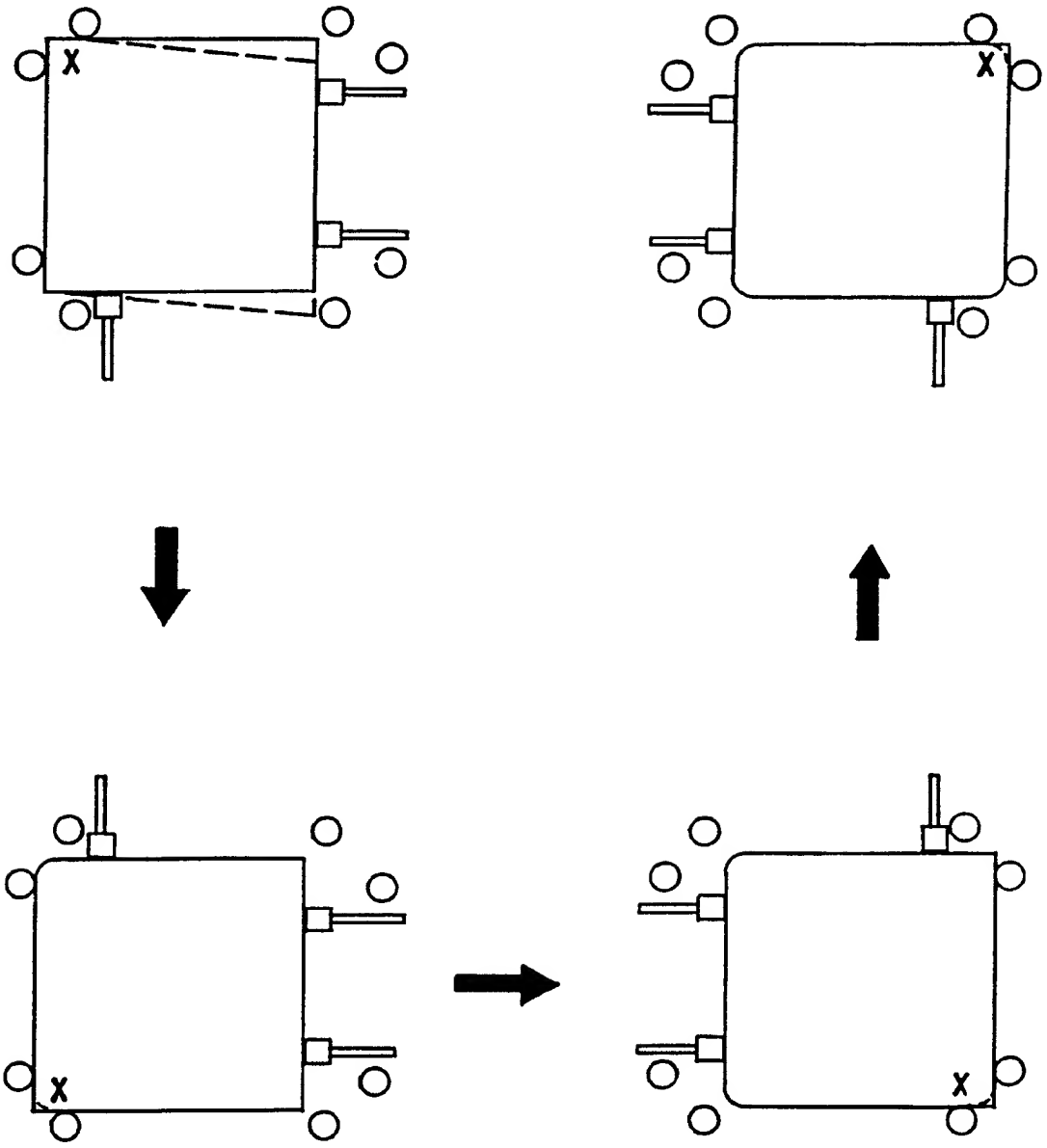


FIG.7

INTERNATIONAL SEARCH REPORT

International Application No PCT/EP 92/02429

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B26F1/12; B26D7/01

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B26D ; B26F ; B65H

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
Y	DE,A,4 104 428 (KOLBUS GMBH & CO KG) 24 October 1991 see column 1, line 53 - column 2, line 53; figures	1,17
Y	US,A,4 132 400 (R. NARAMORE) 2 January 1979	1,17
A	see column 2, line 14 - column 3, line 51; figures	12,13, 15,16
A	DE,A,3 410 000 (VEB KOMBINAT POLYGRAPH) 27 September 1984 see abstract; figures	2,18
A	US,A,3 370 848 (T.C. BARTLETT) 27 February 1968 see column 2, line 30 - line 36; figures 1,3	14

[10] Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
18 DECEMBER 1992	11. 01. 93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	VAGLIENTI G.L.M.

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. EP 9202429 SA 66205

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 18/12/92
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-4104428	24-10-91	JP-A- 4226897	17-08-92
US-A-4132400	02-01-79	None	
DE-A-3410000	27-09-84	None	
US-A-3370848		None	